IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

WSOU INVESTMENTS, LLC d/b/a BRAZOS LICENSING AND DEVELOPMENT,	§ § §	CIVIL ACTION NO. 6:20-cv-541
Plaintiff,	§ §	**JURY TRIAL DEMANDED**
v.	§ §	
HUAWEI TECHNOLOGIES CO., LTD. and HUAWEI TECHNOLOGIES USA INC.,	§ § § §	
Defendants.	§	

ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff WSOU Investments, LLC d/b/a Brazos Licensing and Development ("Brazos" or "Plaintiff"), by and through its attorneys, files this Complaint for Patent Infringement against Defendants Huawei Technologies Co., Ltd. and Huawei Technologies USA Inc. (collectively "Huawei" or "Defendants") and alleges:

NATURE OF THE ACTION

1. This is a civil action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. §§ 1, et seq., including §§ 271, 281, 284, and 285.

THE PARTIES

2. Brazos is a limited liability corporation organized and existing under the laws of Delaware, with its principal place of business at 605 Austin Ave, Ste 6, Waco, TX 76701.

3. On information and belief, Defendant Huawei Technologies Co., Ltd. is a Chinese corporation that does business in Texas, directly or through intermediaries, with a principal place of business at Bantian, Longgang District, Shenzhen 518129, People's Republic of China.

4. Upon information and belief, Defendant Huawei Technologies USA Inc. is a corporation organized and existing under the laws of Texas that maintains an established place of business at 2391 NE Interstate 410 Loop, San Antonio, TX 78217. Huawei Technologies USA, Inc. is authorized to do business in Texas and may be served via its registered agent, CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201-3136.

5. The Defendants operate under and identify with the trade name "Huawei." Each of the Defendants may be referred to individually as a "Huawei Defendant" and, collectively, Defendants may be referred to below as "Huawei" or as the "Huawei Defendants."

JURISDICTION AND VENUE

6. This is an action for patent infringement which arises under the Patent Laws of the United States, in particular, 35 U.S.C. §§271, 281, 284, and 285.

7. This Court has jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a).

8. This Court has specific and general personal jurisdiction over each Huawei Defendant pursuant to due process and/or the Texas Long Arm Statute, because each Huawei

Defendant has committed acts giving rise to this action within Texas and within this judicial district. The Court's exercise of jurisdiction over each Huawei Defendant would not offend traditional notions of fair play and substantial justice because Huawei has established minimum contacts with the forum. For example, on information and belief, Huawei Defendants have committed acts of infringement in this judicial district, by among other things, selling and offering for sale products that infringe the asserted patent, directly or through intermediaries, as alleged herein.

9. Venue in the Western District of Texas is proper pursuant to 28 U.S.C. §§1391(b), (c)(3), and 1400(b) because Huawei Technologies USA Inc. has committed acts of infringement in this judicial district and has a regular and established places of business in this judicial district and in Texas. As non-limiting examples, on information and belief, Huawei Technologies USA Inc. has sold or offered to sell the Accused Products in this judicial district and has employees or agents that operate Huawei equipment in this judicial district, including at 189 CR 265, Georgetown, TX 78626, 1150 S Bell Blvd, Cedar Park, TX 78613, 1399 S A W Grimes Blvd, Round Rock, TX 78664, 12335 IH 35, Jarrell, TX 76537, 1050 Rabbit Hill Rd, Unit #E, Georgetown, TX 78626, 1602 A W Grimes Blvd, Round Rock, TX 78664, 4120 IH 35 N, Georgetown, TX 78626, 900 CR 272, Leander, TX 78641, 1950 Crystal Falls Pkwy, Leander, TX 78641, 1101 N Industrial Blvd, Round Rock, TX 78681, 506 McNeil Rd, Round Rock, TX 78681, 3210 Chisholm Trail Rd, Round Rock, TX 78681, 112 Roundville Ln, Round Rock, TX 78664, 202 Central Dr W, Georgetown, TX 78628, 3595 E Hwy 29, Georgetown, TX 78626, 1402 W Welch St, Taylor, TX 76574, 3801 Oak Ridge Dr, Round Rock, TX 78681, 1957 Red Bud Ln #B, Round Rock, TX 78664, 6603 S Lakewood Dr, Georgetown, TX 78633, 500 W Front, Hutto, TX 78634.

COUNT ONE - INFRINGEMENT OF U.S. PATENT NO. 9084199

10. Brazos re-alleges and incorporates by reference the preceding paragraphs of this Complaint.

11. On July 14, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9084199 ("the '199 Patent"), entitled "Utilization of overhead channel quality metrics in a cellular network." A true and correct copy of the '199 Patent is attached as Exhibit A to this Complaint.

12. Brazos is the owner of all rights, title, and interest in and to the '199 Patent, including the right to assert all causes of action arising under the '199 Patentand the right to any remedies for the infringement of the '199 Patent.

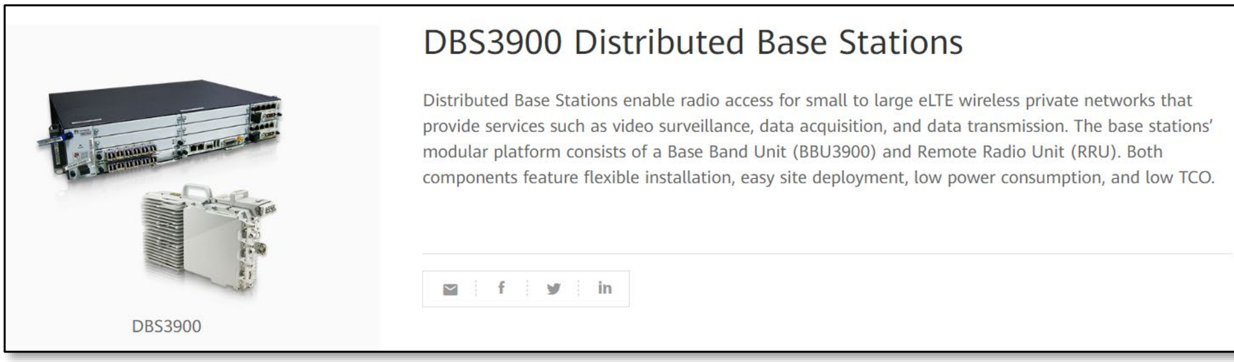
13. Huawei makes, uses, sells, offers for sale, imports, and/or distributes in the United States, including within this judicial district, products such as, but not limited to, Huawei base stations that generate quality metrics to dynamically adjust system or CQI channel configurations and power settings. (collectively, the "Accused Products").

14. The Accused Products include the following:

Product	**Technology**	**URL**
DBS3900 (Distributed Base Stations)	GSM, UMTS, and LTE	https://e.huawei.com/us/products/wireless/elte-trunking/network-element/dbs3900
eLTE-U eAN3810A (AirNode AN3810A)	eLTE (enhanced LTE)	https://e.huawei.com/us/products/wireless/elte-access/base-station/ean3810a
eLTE-U eAN9810A	eLTE (enhanced LTE)	https://e.huawei.com/us/products/wireless/elte-access/base-station/ean9810a
Indoor macro base station BTS3900	GSM-R and LTE	https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900
Outdoor macro base station BTS3900A	GSM-R and LTE	https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900a

15. Huawei provides base stations that supports Long Term Evolution (LTE) as shown. LTE is a packet-based mobile telephony standard used in 4G radio networks to

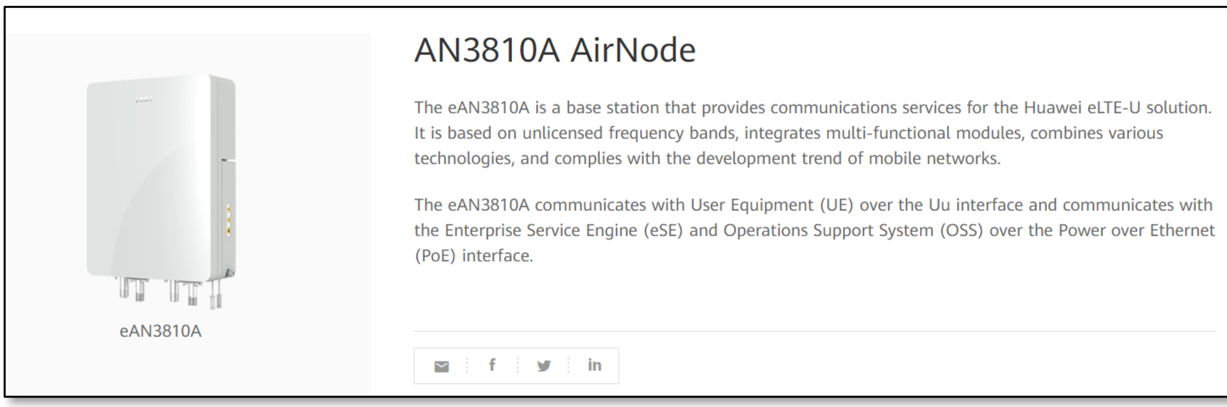
increase data capacity and to speed up the transfer rates. LTE increases the capacity and speed using a different radio interface together with core network improvements.


DBS3900

DBS3900 Distributed Base Stations

Distributed Base Stations enable radio access for small to large eLTE wireless private networks that provide services such as video surveillance, data acquisition, and data transmission. The base stations' modular platform consists of a Base Band Unit (BBU3900) and Remote Radio Unit (RRU). Both components feature flexible installation, easy site deployment, low power consumption, and low TCO.

https://e.huawei.com/us/products/wireless/elte-trunking/network-element/dbs3900

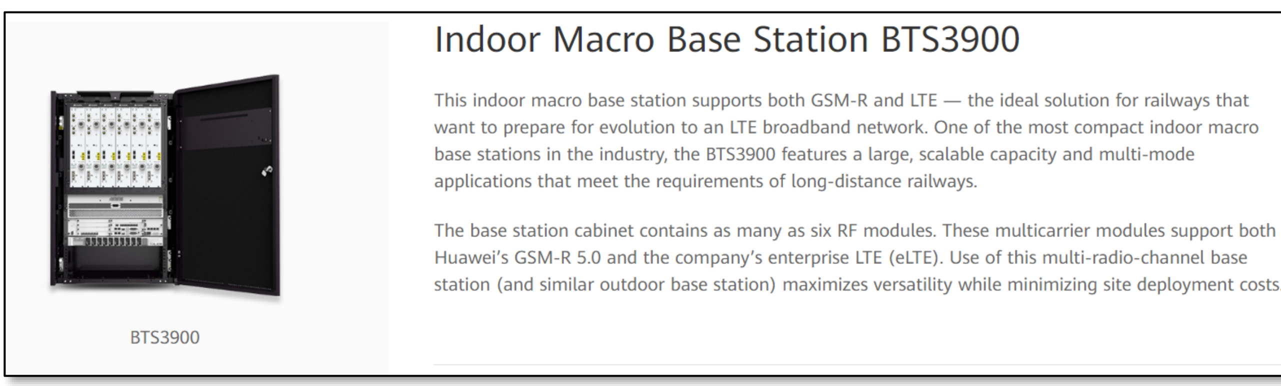

eAN3810A

AN3810A AirNode

The eAN3810A is a base station that provides communications services for the Huawei eLTE-U solution. It is based on unlicensed frequency bands, integrates multi-functional modules, combines various technologies, and complies with the development trend of mobile networks.

The eAN3810A communicates with User Equipment (UE) over the Uu interface and communicates with the Enterprise Service Engine (eSE) and Operations Support System (OSS) over the Power over Ethernet (PoE) interface.

https://e.huawei.com/us/products/wireless/elte-access/base-station/ean3810a


BTS3900

Indoor Macro Base Station BTS3900

This indoor macro base station supports both GSM-R and LTE — the ideal solution for railways that want to prepare for evolution to an LTE broadband network. One of the most compact indoor macro base stations in the industry, the BTS3900 features a large, scalable capacity and multi-mode applications that meet the requirements of long-distance railways.

The base station cabinet contains as many as six RF modules. These multicarrier modules support both Huawei's GSM-R 5.0 and the company's enterprise LTE (eLTE). Use of this multi-radio-channel base station (and similar outdoor base station) maximizes versatility while minimizing site deployment costs.

https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900

Outdoor Macro Base Station BTS3900A

BTS3900A

This outdoor macro base station supports both GSM-R and LTE — the ideal solution for railways that want to prepare for evolution to an LTE broadband network. One of the most compact outdoor macro base stations in the industry, the BTS3900A features a large, scalable capacity and multi-mode applications that meet the requirements of long-distance railways.

The base station cabinet contains as many as six RF modules. These multicarrier modules support both Huawei's GSM-R 5.0 and the company's enterprise LTE (eLTE). Use of this multi-radio base station (and similar indoor base stations) maximizes versatility while minimizing site deployment costs.

https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900a

16. To perform the LTE BLER measurement, the eNodeB sends blocks of data to the UE on the downlink channel. The eNodeB then monitors the positive acknowledgments (ACKs) and negative acknowledgments (NACKs) sent by the UE on the Physical Uplink Control Channel (PUCCH). In addition to ACK/NACK information, the uplink PUCCH also carries channel quality indicator (CQI) information.

17. The base station calculates or generates a measured BLER (Block Error Rate) using a decoding mechanism besides the reported CQI. UE sends the coded signal (i.e., ACK/NACK) in combination with CQI to the base station. Hence, the base station must decode the signal on the Physical Uplink Control Channel (PUCCH) to retrieve the information about CQI and measure the corresponding block error ratio (BLER).

1.1.18 Measurement related to CQI (ChMeas.CQI.Cell)

Overview

Channel Quality Indicator (CQI) indicates downlink channel quality and is calculated by the UE. The UE sends the evaluation result to the eNodeB through the uplink channel. The CQI report is used as the input of MAC scheduling of the eNodeB. The ChMeas.CQI.Cell function subset measures the number CQI reports with a specific value ranging from 0 to 15 in a cell and indicates the overall quality of the downlink channel.

https://www.scribd.com/doc/231267550/BTS3900-V100R008C00SPC220-ENodeB-Performance-Counter-Reference

The UE sends CQI feedback as an indication of the data rate which can be supported by the downlink channel. This helps the eNodeB to select appropriate modulation scheme and code rate for downlink transmission.

The UE determines CQI to be reported based on measurements of the downlink reference signals. The UE determines CQI such that it corresponds to the highest Modulation and Coding Scheme (MCS) allowing the UE to decode the transport block with error rate probability not exceeding 10%.

http://www.ijiee.org/papers/201-X2020.pdf

18. PUCCH is used by UE to send ACK/NACK, SR and Channel Quality Indicator, etc.

Uplink Channels :

- Physical Random Access Channel (**PRACH**) : Carries the random access preamble.
- Physical Uplink Shared Channel (**PUSCH**) : Carries the uplink user data.
- Physical Uplink Control Channel (**PUCCH**) : Carries the HARQ ACK/NACK, Scheduling Request (SR) and Channel Quality Indicator (CQI), etc.

https://www.slideshare.net/chaudaryimran/lte-network-planning-huawei-technologies?from_action=save

19. Huawei base stations receive CQI information and utilizes the received information to select the Modulation and Coding Scheme (MCS). MCS helps in achieving the desired BLER.

This feature brings the following benefits:

- Effectively compensates for the inaccurate CQI measurement and makes the MCS selection more accurate by using a closed-loop mechanism.
- Improves the system capacity by selecting more accurate MCS.
- Allows an adaptive CQI measurement for different scenarios and therefore improves the system capacity.

https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description.

> Under the conventional AMC scheme, the eNodeB chooses a Modulation and Coding Scheme (MCS) for a UE based on the reported CQI. As a result, MCS will mainly change according to the reported CQI. Since the UE measurement error and channel fading could make the reported CQI somewhat inaccurate, the MCS selection based on the inaccurate CQI could cause the DL transmission fails to reach the Block Error Rate (BLER) target. The conventional AMC scheme does not have a closed-loop feedback mechanism to guarantee that the actual BLER reaches the BLER target.
>
> The CQI adjustment scheme introduces a closed-loop mechanism to compensate for the CQI measurement errors. When an eNodeB selects the MCS for the DL transmission, besides the CQI and transmits power, the eNodeB also considers the difference between the target BLER and the actually measured BLER. Note that the actually measured BLER is calculated on the basis of the closed-loop ACK/NACK that the eNodeB received from the DL transmission. In addition, the closed-loop solution used by the CQI adjustment scheme allows the eNodeB to instruct a UE to change the BLER target for CQI reporting, which could maximize the system throughput.

https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description

20. CQI along with the ACK and NACK are utilized to calculate the BLER. The frame erasure rate is a measure of the quality of the signal, which is associated with ACK or NACK.

21. The base station calculates or generates an actually measured BLER (Block Error Rate) using a decoding mechanism besides the reported CQI. Generally, the BLER is related to the CQI, thus can be considered equivalent to quality metrics. Channel Quality Indicator (CQI) is an indicator that carries information about the quality of the communication channel. Depending on the CQI reported by UE, the network transmits data with different transport block sizes. If network gets high CQI value from UE, it transmits the data with larger transport block size and vice versa.

22. There can be different types of BLER measurement (i.e., Initial & Residual) according to conditions.

Adaptive BLER Targets

Firstly, lets understand the concept of BLER. It can be divided into two categories:

- Initial BLER: When the eNB sends data to the UE and UE is unable to decode it, then it will send a HARQ NACK to the eNB. A NACK means that the eNB will have to retransmit the data and this NACK is considered IBLER or Initial Block Error.
- Residual BLER: If the UE is unable to decode the data even after retransmission, the UE will send another NACK and the eNB will have to retransmit again. However, there is a limit to these retransmissions and usually they are configurable. Commonly, these retransmissions are set to 4 and after 4 retransmissions, the eNB will not retransmit at HARQ level and consider this as a Residual Block Error.

The BLER target is maintained by the IBLER so this means that the eNB tries to maintain an IBLER of 10% for each UE. RBLER is usually very low and it is supposed to be less than 0.5%. The question may arise that why don't we reduce the IBLER further and make it low as that should reduce retransmissions. The problem here is that lowering IBLER means that we need to lower the MCS. Even a very low MCS will not ensure a linear decrease in IBLER but it will degrade throughput excessively. So, various simulations and field trials were done to come up with an optimum target of 10% for IBLER which is followed by most of the vendors.

https://ourtechplanet.com/lte-throughput-optimization-part-2-spectral-efficiency/

- If **CqiAdjAlgoSwitch** is set to **Off**, the DL CQI adjustment algorithm is not used. The scheduler sel… DL CQI adjustme…

• Why the optimum IBLER value is 10%.
• Which scenarios apply this value.

- If **CqiAdjAlgo**… eB adjusts the UL … the adjusted CQI, the DL scheduler adjusts the MCS to reduce the initial block error rate (IBLER) to a specified target value and maximize the system throughput.

An appropriate target IBLER value is crucial for efficient transmission and resource usage. If the target IBLER value is set to a too low value, a low-order MCS will be selected for DL data packets and the transmission efficiency will be reduced. If the target IBLER value is set to a too high value, a high-order MCS will be selected for DL data packets. Consequently, the number of DL retransmissions increases and system resources are wasted. Based on analysis results, the optimum target IBLER value is 10%. In some cases, increasing the target IBLER value can improve the spectral efficiency for cell edge users and users in the middle area or center of a cell transmitting small packets. Increasing the target IBLER can also improve the capacity of heavily loaded cells. Whether to use adaptive target IBLER value is controlled by the **DlVarIBLERtargetSwitch** switch. If this switch is set to **Off**, the target IBLER value approximates to 10%. If this switch is set to **On**, the target IBLER value approximates to 30%.

Explicit description

Page 12 HUAWEI

http://download.huawei.com/download/filedownload.do?modelID=bulletin&refID=IN0000058152,101

23. The actually measured BLER is considered equivalent to quality metrics that is calculated on the basis of ACK/NACK along with CQI that the eNodeB receives from UE. When the eNodeB sends data to the UE and UE is unable to decode it, then UE sends a HARQ

negative acknowledgment (NACK) to the eNodeB. A NACK means that the eNodeB will have to retransmit the data and this NACK is considered IBLER or Initial Block Error (i.e., short-term quality metrics). The network would send a large transport block size according to the CQI value, and it would become highly probable that UE fails to decode it (cause CRC error on UE side), and UE sends NACK to network, and the network has to retransmit it which in turn cause waste of radio resources.

24. If the UE is unable to decode the data even after retransmission, the UE will send another NACK, and the eNodeB will have to retransmit again. However, there is a limit to these retransmissions, and usually, they are configurable. Commonly, these retransmissions are set to 4, and after 4 retransmissions, the eNodeB will not retransmit at HARQ level and consider this as a Residual Block Error (i.e., long-term quality metrics calculated over multiple frames).

> **Adaptive BLER Targets**
>
> Firstly, lets understand the concept of BLER. It can be divided into two categories:
>
> - **Initial BLER:** When the eNB sends data to the UE and UE is unable to decode it, then it will send a HARQ NACK to the eNB. A NACK means that the eNB will have to retransmit the data and this NACK is considered IBLER or Initial Block Error.
> - **Residual BLER:** If the UE is unable to decode the data even after retransmission, the UE will send another NACK and the eNB will have to retransmit again. However, there is a limit to these retransmissions and usually they are configurable. Commonly, these retransmissions are set to 4 and after 4 retransmissions, the eNB will not retransmit at HARQ level and consider this as a Residual Block Error.
>
> The BLER target is maintained by the IBLER so this means that the eNB tries to maintain an IBLER of 10% for each UE. RBLER is usually very low and it is supposed to be less than 0.5%. The question may arise that why don't we reduce the IBLER further and make it low as that should reduce retransmissions. The problem here is that lowering IBLER means that we need to lower the MCS. Even a very low MCS will not ensure a linear decrease in IBLER but it will degrade throughput excessively. So, various simulations and field trials were done to come up with an optimum target of 10% for IBLER which is followed by most of the vendors.

https://ourtechplanet.com/lte-throughput-optimization-part-2-spectral-efficiency

25. The Physical Uplink Control Channel (PUCCH) is used by UE to send SR, Channel Quality Indicator along with the ACK/NACK. The Residual BLER (i.e., long-term quality metrics) is calculated on the basis of ACK/NACK reported on the PUCCH. Therefore,

it can be construed that the calculation of Residual BLER (i.e., long-term quality metrics) requires filtering out the ACK and NACK information from the PUCCH signal over several frames (i.e., long-term filtering)

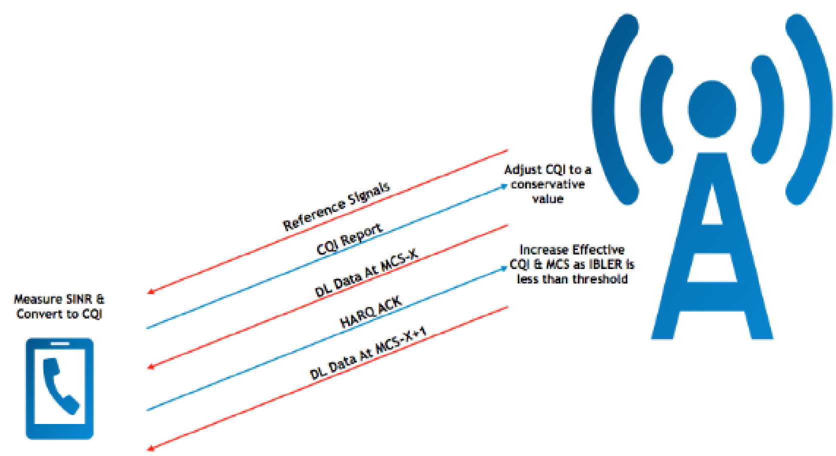
Uplink Channels :

- Physical Random Access Channel (**PRACH**) : Carries the random access preamble.
- Physical Uplink Shared Channel (**PUSCH**) : Carries the uplink user data.
- Physical Uplink Control Channel (**PUCCH**) : Carries the HARQ ACK/NACK, Scheduling Request (SR) and Channel Quality Indicator (CQI), etc.

https://www.slideshare.net/chaudaryimran/lte-network-planning-huawei-technologies?from_action=save

Similarly, if the UE sends a CQI value of 8 and eNB initiates downlink data with a MCS of 16 and it finds out that the BLER value is below 10%, it will increase MCS to 17 or 18 until the BLER target is achieved. This scenario will increase the spectral efficiency and the throughput.

So, we need to ensure that CQI adjustment or dynamic CQI assignment algorithms or outer loop control based on BLER is activated to achieve maximum gains from the channel.



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26. Huawei eNodeB uses reported CQI to achieve the target BLER by selecting the appropriate MCS.

The CQI adjustment scheme enhances the conventional AMC scheme by introducing downlink CQI adjustment. It could provide additional performance gains.

Under the conventional AMC scheme, the eNodeB chooses a Modulation and Coding Scheme (MCS) for a UE based on the reported CQI. As a result, MCS will mainly change according to the reported CQI. Since the UE measurement error and channel fading could make the reported CQI somewhat inaccurate, the MCS selection based on the inaccurate CQI could cause the DL transmission fails to reach the Block Error Rate (BLER) target. The conventional AMC scheme does not have a closed-loop feedback mechanism to guarantee that the actual BLER reaches the BLER target.

The CQI adjustment scheme introduces a closed-loop mechanism to compensate for the CQI measurement errors. When an eNodeB selects the MCS for the DL transmission, besides the CQI and transmits power, the eNodeB also considers the difference between the target BLER and the actually measured BLER. Note that the actually measured BLER is calculated on the basis of the closed-loop ACK/NACK that the eNodeB received from the DL transmission. In addition, the closed-loop solution used by the CQI adjustment scheme allows the eNodeB to instruct a UE to change the BLER target for CQI reporting, which could maximize the system throughput.

https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description

27. In LTE, the user equipment (UE) (also known as a mobile station) monitors the quality of the downlink wireless channel and periodically reports this information to the base station (referred to here as Node B) on the uplink. This feedback, called Channel Quality Indicator (CQI) in addition to ACK and NACK, is an indication of the highest data rate that the UE can reliably receive in the existing conditions on the downlink wireless channel.

28. The BLER target (i.e., quality setting) is assigned to the downlink channel. The measured BLER, which is considered equivalent to quality metrics, is calculated, and further, the actually measured BLER is compared to target BLER. The target BLER is considered equivalent to a quality setting for providing CQI adjustment.

The CQI adjustment scheme enhances the conventional AMC scheme by introducing downlink CQI adjustment. It could provide additional performance gains.

Under the conventional AMC scheme, the eNodeB chooses a Modulation and Coding Scheme (MCS) for a UE based on the reported CQI. As a result, MCS will mainly change according to the reported CQI. Since the UE measurement error and channel fading could make the reported CQI somewhat inaccurate, the MCS selection based on the inaccurate CQI could cause the DL transmission fails to reach the Block Error Rate (BLER) target. The conventional AMC scheme does not have a closed-loop feedback mechanism to guarantee that the actual BLER reaches the BLER target.

The CQI adjustment scheme introduces a closed-loop mechanism to compensate for the CQI measurement errors. When an eNodeB selects the MCS for the DL transmission, besides the CQI and transmits power, the eNodeB also considers the difference between the target BLER and the actually measured BLER. Note that the actually measured BLER is calculated on the basis of the closed-loop ACK/NACK that the eNodeB received from the DL transmission. In addition, the closed-loop solution used by the CQI adjustment scheme allows the eNodeB to instruct a UE to change the BLER target for CQI reporting, which could maximize the system throughput.

https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description

29. The base station must take care of the spectral efficiency. The base station (eNodeB) adjusts the CQI value (which is reported by UE) by comparing the measured BLER and target BLER in order to implement corresponding MCS.

CQI Adjustment Algorithms

The eNB adjusts the raw CQI value shared by the UE to find an optimum CQI and this provides a higher spectral efficiency. There are basically two scenarios where this comes into play

Consider a UE-1 that measures its SINR value to be around 10 dB and based on that it calculates a CQI of 9 and sends it to the eNB. Another UE, let's call it UE-2, measures its SINR value to be around 8 dB but based on that it sends CQI of 9 as the UEs have different chipsets from different vendors and can have a different CQI value for same SINR indexes. The eNB will have two UEs with same CQI value and if the eNB provides both of them with the same MCS (for example MCS20) then it is possible that the UE-1 might be able to work with MCS20 but the UE-2 will not be able to decode MCS20 properly at 8 dB SINR. So, to address this issue, the eNB maintains another index which is like the outer loop of BLER (Block Error Rate). Most of the vendors maintain a BLER target of 10%. Now consider the same scenario, both UEs get MCS20 and UE-1 works with a BLER value of 10% but the UE-2 had lower SINR so it will have a relatively higher BLER. Let's say, the eNB calculates the BLER to be around 13% so the eNB will lower the MCS for the UE-2 and make it 19. If the BLER still remains above 10%, the eNB will reduce it further to ensure that the BLER target is maintained.

https://ourtechplanet.com/lte-throughput-optimization-part-2-spectral-efficiency/

30. Considering the difference between the target BLER and the measured BLER, CQI adjustment can be done. Based on the ACK/NACK indication from the UE on the optimum BLER target, the eNodeB (or base station) calculates the CQI offset. The eNodeB

then uses the CQI offset to adjust the CQI. CQI adjustment schemes allow the eNodeB to achieve the target BLER, which leads to maximizing the system throughput.

> The CQI adjustment scheme enhances the conventional AMC scheme by introducing downlink CQI adjustment. It could provide additional performance gains.
>
> Under the conventional AMC scheme, the eNodeB chooses a Modulation and Coding Scheme (MCS) for a UE based on the reported CQI. As a result, MCS will mainly change according to the reported CQI. Since the UE measurement error and channel fading could make the reported CQI somewhat inaccurate, the MCS selection based on the inaccurate CQI could cause the DL transmission fails to reach the Block Error Rate (BLER) target. The conventional AMC scheme does not have a closed-loop feedback mechanism to guarantee that the actual BLER reaches the BLER target.
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> The CQI adjustment scheme introduces a closed-loop mechanism to compensate for the CQI measurement errors. When an eNodeB selects the MCS for the DL transmission, besides the CQI and transmits power, the eNodeB also considers the difference between the target BLER and the actually measured BLER. Note that the actually measured BLER is calculated on the basis of the closed-loop ACK/NACK that the eNodeB received from the DL transmission. In addition, the closed-loop solution used by the CQI adjustment scheme allows the eNodeB to instruct a UE to change the BLER target for CQI reporting, which could maximize the system throughput.

https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description

2.3.2.1 CQI Adjustment

The eNB adjusts the UE reported CQI value by taking into account ACK/NACK (acknowledged/not acknowledged) reports from the UE for received downlink data blocks. The adjusted CQI value is used by link adaptation functionality to select the optimum MCS to achieve BLER target. Starting from the initial value, the CQI offset will be adjusted (StepUp or StepDown) in response to the ACK/NACK for the new transmission of a transport block (Figure 2.30).

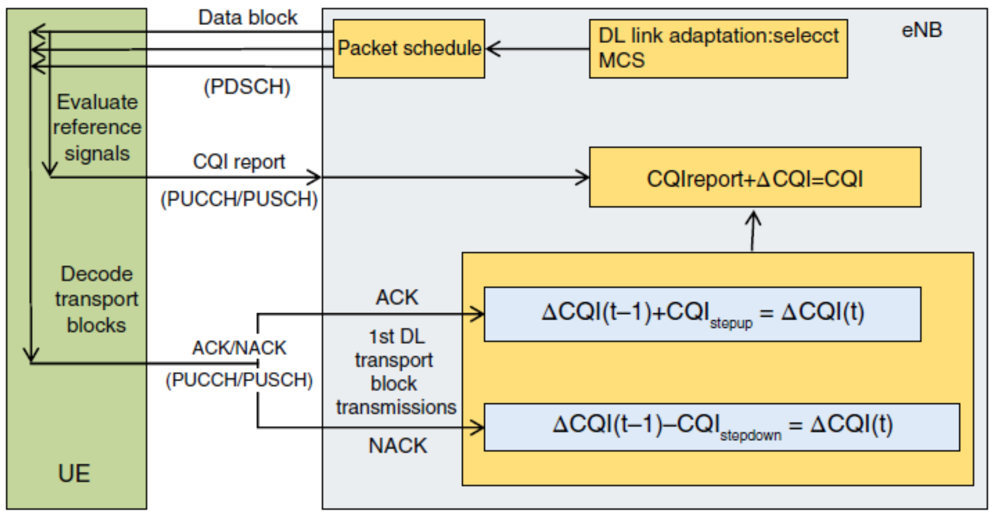

Figure 2.30 CQI adjustment.

LTE Optimization Engineering Handbook, John Wiley & Sons, Sep 14, 2017, Page 69 &7.

31. The base station must take care of the spectral efficiency. The base station (eNodeB) adjusts the CQI value (which is reported by UE) by comparing the measured BLER and target BLER in order to implement corresponding MCS. Most of the vendors/service providers maintain a BLER target of 10%. Thus, CQI adjustment plays a vital role in deciding the MCS and achieving the desired BLER.

CQI Adjustment Algorithms

The eNB adjusts the raw CQI value shared by the UE to find an optimum CQI and this provides a higher spectral efficiency. There are basically two scenarios where this comes into play

Consider a UE-1 that measures its SINR value to be around 10 dB and based on that it calculates a CQI of 9 and sends it to the eNB. Another UE, let's call it UE-2, measures its SINR value to be around 8 dB but based on that it sends CQI of 9 as the UEs have different chipsets from different vendors and can have a different CQI value for same SINR indexes. The eNB will have two UEs with same CQI value and if the eNB provides both of them with the same MCS (for example MCS20) then it is possible that the UE-1 might be able to work with MCS20 but the UE-2 will not be able to decode MCS20 properly at 8 dB SINR. So, to address this issue, the eNB maintains another index which is like the outer loop of BLER (Block Error Rate). Most of the vendors maintain a BLER target of 10%. Now consider the same scenario, both UEs get MCS20 and UE-1 works with a BLER value of 10% but the UE-2 had lower SINR so it will have a relatively higher BLER. Let's say, the eNB calculates the BLER to be around 13% so the eNB will lower the MCS for the UE-2 and make it 19. If the BLER still remains above 10%, the eNB will reduce it further to ensure that the BLER target is maintained.

https://ourtechplanet.com/lte-throughput-optimization-part-2-spectral-efficiency/

32. In view of preceding paragraphs, each and every element of at least claim 1 of the '199 Patent is found in the Accused Products.

33. Huawei has and continues to directly infringe at least one claim of the '199 Patent, literally or under the doctrine of equivalents, by making, using, selling, offering for sale, importing, and/or distributing the Accused Products in the United States, including within this judicial district, without the authority of Brazos.

34. Huawei has received notice and actual or constructive knowledge of the '199 Patent since at least the date of service of this Complaint.

35. Since at least the date of service of this Complaint, through its actions, Huawei has actively induced product makers, distributors, retailers, and/or end users of the Accused Products to infringe the '199 Patent throughout the United States, including within this judicial district, by, among other things, advertising and promoting the use of the Accused Products in various websites, including providing and disseminating product descriptions, operating manuals, and other instructions on how to implement and configure the Accused

Products. Examples of such advertising, promoting, and/or instructing include the documents at:

- https://e.huawei.com/us/products/wireless/elte-trunking/network-element/dbs3900
- https://e.huawei.com/us/products/wireless/elte-access/base-station/ean3810a
- https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900
- https://e.huawei.com/us/products/wireless/gsm-r/radio-access-network/bts3900a
- https://www.scribd.com/doc/231267550/BTS3900-V100R008C00SPC220-ENodeB-Performance-Counter-Reference
- http://www.ijiee.org/papers/201-X2020.pdf,
- https://www.slideshare.net/chaudaryimran/lte-network-planning-huawei-technologies?from_action=save

- https://www.scribd.com/document/419580448/Document-1-eLTE2-2-DBS3900-LTE-FDD-Optional-Feature-Description
- https://ourtechplanet.com/lte-throughput-optimization-part-2-spectral-efficiency/
- http://download.huawei.com/download/filedownload.do?modelID=bulletin&refID=IN0000058152,101

36. Since at least the date of service of this Complaint, through its actions, Huawei has contributed to the infringement of the '199 Patent by having others sell, offer for sale, or use the Accused Products throughout the United States, including within this judicial district, with knowledge that the Accused Products infringe the '199 Patent. The Accused Products are especially made or adapted for infringing the '199 Patent and have no substantial non-infringing use. For example, in view of the preceding paragraphs, the Accused Products contain functionality which is material to at least one claim of the '199 Patent.

JURY DEMAND

Brazos hereby demands a jury on all issues so triable.

REQUEST FOR RELIEF

WHEREFORE, Brazos respectfully requests that the Court:

(A) Enter judgment that Huawei infringes one or more claims of the '199 Patent literally and/or under the doctrine of equivalents;

(B) Enter judgment that Huawei has induced infringement and continues to induce infringement of one or more claims of the '199 Patent;

(C) Enter judgment that Huawei has contributed to and continues to contribute to the infringement of one or more claims of the '199 Patent;

(D) Award Brazos damages, to be paid by Huawei in an amount adequate to compensate Brazos for such damages, together with pre-judgment and post-judgment interest for the infringement by Huawei of the '199 Patent through the date such judgment is entered in accordance with 35 U.S.C. §284, and increase such award by up to three times the amount found or assessed in accordance with 35 U.S.C. §284;

(E) Declare this case exceptional pursuant to 35 U.S.C. §285; and

(F) Award Brazos its costs, disbursements, attorneys' fees, and such further and additional relief as is deemed appropriate by this Court.

Dated: June 17, 2020

Respectfully submitted,

/s/ James L. Etheridge

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